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RECENT ADVANCES IN OPHTHALMOLOGY AND THE DEVELOPING WORLD

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The present world population is more than 45,000 lakhs of which 70% is in the developing countries. Each year the population is increasing by 700 lakhs and in the absence of major catastrophe may reach the 70,000 lakhs mark by the end of the present century (21). About 1% of present population, i.e., 450 lakhs are economically blind with visual acuity of less than 6/60 of whom 280 lakhs have visual acuity below 3/60 (51). Most of the curable blind are in developing countries. In India alone 90 lakhs are economically blind of whom 34 lakhs have acuity of vision below 3/60 (19) and 450 lakhs are visually handicapped. Blindness prevalence is 0.1 - 0.3% in developed countries whereas it is a staggering 1 - 1.4 % in developing countries.

RECENT ADVANCES IN OPHTHALMOLOGY

In 1957, Wald, Hartline and Granit received Nobel Prizes for their studies on retinal chemistry and physiology. In 1981,Hubel and Weisel received the same for studies on development of cortical vision. The discipline of Ophthalmology has seen many developments since then. Ophthalmic surgery has moved from the era of macro to micro surgery and is entering an era of cellular surgery. The change has been from 6-0 silk sutures to 10-0 nylon and perlon, from removable sutures to buried and absorbable, from 6-7mm thick eyed needles to 4-5mm atraumatic swaged eyeless fine needles and from thick mucosal DCR flaps to anterior lens capsule flaps. Spectacles have changed to contact lenses and aphakic glasses to intra-ocular lens implants. Successful refractive keratoplasty has become a reality.

Advances in Basic Sciences

Polyol pathway of reducing glucose to sorbital and fructose has been shown to be operative in sugar cataracts and these cataracts can be reversed by the inhibitors of aldose - reductase enzyme (23,27). This pathway may be involved in other diabetic complications like retinopathy and nephropathy (9). An aldose - reductase inhibitor, Sulindac, has been shown to be effective in controlling and reversing earliest changes of diabetic retinopathy (13).

Cataract is the commonest cause of world blindness (44). Its actiology is still unknown. Oxidative stresses and photosensitisation are now being linked with cataractogenesis (52).

Corneal graft rejections can often be controlled with corticosteroids and other immunosuppressants. Cyclosporin-A a specific inhibitor of T-lymphocytes, holds a new promise and may prove to be a wonder drug for the 'often-difficult-to-manage' uveal inflammations (43).

New insights into the finer details of ocular structure are possible today due to electron microscopy and immunohistochemistry (5).

Studies on Vitamins A and E deficient mice have shown early exfoliation of corneal epithelium and disruption of retinal rod outer segments. The studies uncovered complimentary role of Vitamin E in Vitamin A deficiency states (15).

Diagnostic Advances

Ophthalmic diagnostics have been revolutionised by recent advances in technology. Details of retinal and iris microcirculation can be studied with Fluorescein Angiography improving our diagnostic capabilities considerably. Vitreous photoflurophotometry gives the earliest indication of barrier function failure of retinal microcirculation, the earliest sign of diabetic retinopathy (12).

Ultrasound has found new uses in ophthalmology (14,38). Time amplitude A-Scan, brightness mode B-Scan, motion M-Scan and doppler ultrasonography are already available and others are being developed. Ultrasonography accurately measures individual eye component size explores orbital lesions and studies posterior segment in patients with hazy media. Ultrasonic pachometry has proved to be accurate in estimation of corneal thickness. Ultrasonography is valuable in measuring power of the IOL with the obvious advantage of being non-invasive and nontoxic.

Retinal function can be accurately assessed by electro retinography (ERG) and electro oculography (EOG). Visually evoked cortical potentials enable study of central neurological pathways (42). Electromyography and nystagmography aid diagnosis of myopathies and neurophthalmic disorders respectively. Optokinetic nystagmography is a specialised form of nystagmography which accurately assess the visual acuity even in children and helps in diagnosis of lesions at different cortical levels.

Visual field testing continues to be important in ophthalmic and neurological diagnosis. For static and kinetic perimetry sophisticated automated instruments are available which accomplish the test in three to five minutes (50). These automated perimeters can be very useful in community screening for glaucoma.

Instruments like laser interferometer, blue dot entoptoscope and visual acuity meters are available today for preoperative vision assessment in cases of opaque media (17). Refraction can be accomplished rapidly and automatically with autorefractors. Non-contact pneumatic tonometers form another major development. Stereoscopic fundus camera is available for accurate documentation of glaucomatous cupping and optic disc

oedema. The specular microscope is used to study corneal endothelial density and morphology which are of crucial importance in keratoplasty and cataract surgery, IOL implants and evaluation of donor corneas (33,34).Tear analysis and conjuctival biopsy help in diagnosis of various systemic disorders and prenatal diagnosis of many ophthalmic conditions and metabolic disorders affecting the eye (4).

Advances in Therapeutics

The increasing and indiscriminate use of broad spectrum antibiotics has caused emergence of resistant strains of microbes. There is a change in trend of eye infections. Bacteria used to be the commonest ocular pathogens; but now fungal and viral infections are showing a rising incidence. Use of steroids is another factor in this changing trend. Potent anti-fungal and anti-viral drugs are now available. Interferon has been successful in aborting viral epidemic haemorrhagic conjunctivitis. Acyclovir and triflurothymidine are effective new antiviral drugs (25).Newer fungal drugs include ketaconazole, miconazole, econazole and natamycin. Studies indicate silver sulfadiazine, a cheap and easily available antimicrobial, to be potent in mycotic keratitis.

It has been remarked that every 20 years there is a breakthrough in glaucoma research. In 1857,von Creefe began the era of glaucoma therapy with peripheral iridectomy. Twenty years later came pilocarpine. Near the end of 19th century fistulisation operations were developed. In 1920, Koeppe gonioscopy lens and slit lamp came into use.In the 40s Barkon distinguished the two basic types of glaucoma. Carbonic anhydrase inhibitors became available in the 60s. The '80s brought in beta blockers, laser trabeculoplasty and laser iridectomy. Therapeutic ultrasound may be a new approach in the mangement of difficult glaucoma(6,7) and medical trabeculotomy may become a reality (24).

Cataracts are the commonest causes of blindness. Aspirin (10), Vitamins E and C, glutathione and aldose-reductase inhibitors have been suggested useful. Extensive cooperative research is being carried out internationally in this and in epidemiology of cataract (30).

Ninety percent of medication instilled topically in eyes is washed away in a minute or two. For prolonging the topical action of drugs, methyl cellulose, soft contact lenses and Ocuserts have proved very useful.Ocuserts is the tradename of co-polymer plastic inserts which consist of a central drug containing core surrounded by flexible transparent outer layers. Placed beneath the eyelid,it delivers a continuous dose of the drug to the tear film (11).

Contact lenses of increasing versatility are being added to the armamentarium of the ophthalmologist each year and today, besides as optical sytems, they are used for therapeutic purposes. Newer contact lenses can be used continuously for a period of even upto six months without removal in between (28).

Surgical Advances

This is the era of micro-surgery with its attendant instrumentation of exquisite fineness. Lasers have added a new dimension and the whole approach to

management of ophthalmic diseases has undergone drastic changes. Xenon lasers followed by finer and precise argon and krypton lasers are finding increased applications in ophthalmology(8). These lasers are used for tissue destruction and their uses include management of glaucoma surgery, tumour destruction and diabetic neovascularisation surgery. For the first time, intraocular surgery can be accomplished using the Nd-YAG laser without incising the eye (45). Excimer lasers make corneal incisions of utmost precision for radial keratotomy (40). More advanced systems such as tunable dye lasers will soon be available for clinical use.

The 70s were the decade of vitreous surgery. The 80s are turning to be the decade of corneal surgery, which has attained far more precision and reliability. Special media and procedures permit corneal preservation for long periods. With the use of typed corneal tissue, advances in immunosuppression and better control of corneal vascularisation, high success rate should be possible in keratoplastic procedures. When keratoplasty is not practicable keratoprosthesis remains a viable alternative (2).

Radial keratotomy to correct myopia seems to be the most promising of refractive surgery. Good results have been reported in a multi-centre study in USA (48).Other refractive keratoplastic procedures such as keratophakia which involves placing a donor disc intralamerally in host cornea and keratomileusis in which host stromal disc is reshaped with a cryolathe before replacement in its original bed, are complex procedures needing computer assistance (20,47). Epikeratophakia is superficial placement of a donor disc on the host cornea and has the advantage of being reversible and this procedure has been successfully accomplished in children (49). For astigmatism, techniques like relaxing corneal incisions, Ruiz technique and wedge resection of the cornea are finding acceptance (46).

Cataract surgery even after perfect surgical results lead to aphakic problems which can be relieved to a large extent by the use of contact lenses.The best solution today is intraocular lens implantation. Lens surgery has seen dramatic shifts. First, extra capsular surgery was the routine. Later it was realised that intra capsular extraction offered many more advantages. With the advent of microsurgery, extra capsular cataract surgery is gaining popularity (18). This shift has been partly due to advances in implant surgery. 70% of cataract extractions in the US are associated with implants (41). It has been accepted that posterior chamber lenses with retained posteripr capsule may be more suitable. The implant material is usually PMMA; now flexible silicone lenses have been introduced. Viscoelastic substances such as sodium hyaluronate, chondroitin sulphate and methyl cellulose greatly facilitate surgical manoeuvres and limit ocular trauma (3). The crude needling procedure has been replaced by sophisticated procedures like phacoemulsification and pars plana lensectomy (26).

RELEVANCE TO DEVELOPING COUNTRIES.

The main causes of world blindness are :-

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RELEVANCE TO DEVELOPING COUNTRIES.

The main causes of world blindness are :-

Cataract (Cause of 55% of blindness in India).

Trachoma (Affects about 5500 lakhs; more than 20 lakhs being blind).

Glaucoma.

Vitamin A deficiency (Afflicts mainly children affecting 50 lakhs worldwide each year. 30,000 are blinded by keratomalacia each year in India and 2.5 lakhs worldwide).

Trauma (Largely preventable, warranting effective industrial safety legislations).

Onchocerciasis (Seen in West & East Africa affecting 250 lakhs).

Gonococcal Ophthalmia.

Smallpox (A great scourge of the past, globally eradicated in 1975).

Approach to the Problem

What is the relevance of the recent advances in Ophthalmology to the developing world? There are urgent problems such as malnutrition, starvation and basic survival affecting many nations. Surely what is called for is a just world economic order with equal distribution and opportunity for all. Blindness has not only got grave social consequences but also is a huge drain and burden on a nation's economy. Thus, it is important that each nation takes effective measures towards blindness prevention and cure.India was the first developing nation to launch a national programme for the control of blindness in 1976. About 20 countries followed.

Constraints in Developing Countries

What is needed is war on poverty and underdevelopment. The frontline in the long war on poverty and underdevelopment is and remains the struggle for economic justice and growth. To deal with this problem policy makers must first obtain some quantitative information about the extent and the severity of the problem,then estimate the feasibility and cost before launching one of the several possible intervention programmes and finally decide the priority to be given (39).

Social ignorance has to give way to information.Many people in rural areas, due to lack of awareness, do not even make use of available services (31).

Urban rural doctor-patient ratio needs to be corrected by training more personnel for the required and urgent needs.

Priorities in Developing Countries

Epidemiological: Due to the federal structure, large size and diversity. of conditions found in the country, development of health services has tended to proceed on an area-by-area basis. This has often involved the use of pilot projects designed to test operational strategies in specific settings (1). Magnitude identification by epidemiological studies is very important for proper allocation of available funds. It was only with the publication of ICMR figures on prevalence of blindness in the country that the magnitude of the problem was realised (19). This prompted the central health council to launch the National Programme for Control of Blindness (NPCB).

Services: Certainly all the recent advances in Ophthalmology should be made available to everyone. However, priorities have to be decided based on each developing country's individual needs. Services have to be made cost effective and cost-benefit ratio to the society assessed before national priorities are implemented (36). Research should be of national relevance and restricted to specialised centres. Ophthalmic services need to be provided at all levels. At each level appropriate manpower and essential equipment and drugs should be provided. Integration of eye care with general health care at the primary level remains an important objective.

Community participation : Community participation is central to any successful campaign of national importance. Health is individual and multisectorial responsibility. Community must realise that health development is community development (22).

Infrastructure : Population doctor/specialist ratio should be targeted and training facilities developed in phased manner. Similarly the bed requirements should be estimated per district and private and public sector resources mobilized to achieve the target. Under the Indian Programme it is planned to have one eye surgeon for 50,000 population and one eye bed for 10,000 population by the year 2,000 AD. Para medical technicians can be trained to assist the medical officers and specialists to help provide primary eye care in the rural areas.

Resource utilization : Planned utilization of the possible resources is very crucial for developing nations (37). Whereas primary health care services should be provided to most and on priority basis, training and specialised services should not be totally ignored. Research, particularly health services research, is essential for developing countries and all research spending should be judicious and organised in a few selected centres and in priority areas. Cost-benefit ratio should be considered while introducing advanced technology. Eye camp approach is most appropriate where permanent infrastructure cannot be created.

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